

Research: Air, Climate and Energy

Program Area: Research: Air, Climate and Energy

Goal: Addressing Climate Change and Improving Air Quality

Objective(s): Address Climate Change; Improve Air Quality

(Dollars in Thousands)

	FY 2015 Actuals	FY 2016 Enacted	FY 2017 Pres Bud	FY 2017 Pres Bud v. FY 2016 Enacted
<i>Science & Technology</i>	<i>\$84,453.4</i>	<i>\$91,906.0</i>	<i>\$101,151.0</i>	<i>\$9,245.0</i>
Total Budget Authority / Obligations	\$84,453.4	\$91,906.0	\$101,151.0	\$9,245.0
Total Work-years	279.2	287.8	285.8	-2.0

Program Project Description

Climate change is threatening 45 years of innovation-driven progress in improving air quality in the United States. Current approaches in reducing air pollution are complicated by rapidly changing energy technologies, which have benefits (e.g. lower output of harmful emissions) and potential adverse effects (e.g. emissions and impacts over the full life-cycle). The EPA is countering these challenges by continuing research in the following areas: addressing climate change and improving air quality, developing air sensor technologies, and providing evidence-based environmental information for community self-empowerment and utilization.

The EPA is requesting \$101 million to fund the Air, Climate and Energy (ACE) research program. Funding will provide critical science support to inform the development and implementation of the National Ambient Air Quality Standards (NAAQS) under the Clean Air Act (CAA). The ACE program will continue to study the relationships between air pollution, climate change, and energy production to develop innovative solutions for improving air quality and addressing climate change. The serious global consequences for economic growth and public health posed by climate change creates significant challenges to achieving sustainable development. The research that the ACE program produces will build upon its record of providing measurable benefits to federal, state, and local partners and the general public, by providing readily available tools and information to improve air quality and prepare for the impacts of climate change.

The ACE research program relies on successful partnerships with other EPA programs and centers, academic and industry researchers, state, local and private sector organizations, as well as key federal agencies. This budget aligns with the Agency's *FY 2014 to FY 2018 Strategic Plan*, Agency Priority Goals, and Federal Priority Goals, such as the Clean Energy pledge¹.

Recent Accomplishments

- Developed an integrated atmospheric deposition and watershed modeling system to jointly model air and watershed processing of environmental pollutants
- Expanded the deployment of Village Green monitoring stations to four locations in the United States and at a school in Hong Kong

¹For more information, <http://mission-innovation.net/>

- Created a Coastal Biodiversity Risk Analysis Tool (CBRAT) to predict vulnerability of near-coastal species to climate change
- Established framework and method for assessing vulnerabilities of different wetlands to climate change
- Conducted two pilot case studies to demonstrate how analytic Robust Decision Making (RDM) methods can be used to identify future vulnerabilities in total maximum daily load (TMDL) implementation plans

FY 2017 Budget Request

The ACE program features five different topic areas, which focus on research projects that support the EPA's mission to protect human health and the environment, fulfill the Agency's legislative mandates, and advance cross-Agency priorities. The following request emphasizes a need for a continuation of research across all topic areas, which provides innovative science and engineering to address climate change and air quality problems in the United States.

Topic 1: Climate Impacts, Vulnerability and Adaptation (CIVA)

The EPA will continue to develop methods and tools to investigate how increased temperatures and other climate-driven situations interact with air pollutants to impact health, as well as examine the vulnerability of watersheds and ecosystems. The research and tools will support the U.S. Global Change Research Program (USGCRP) priority topics¹, and the President's Climate Action Plan.² The following describes two of ACE's on-going critical projects in the area of air, water quality and health/ecosystems research.

Climate Impacts on Air Quality, Human Health, & Terrestrial Ecosystems

To mitigate the risks of climate change, the EPA will continue to develop regional climate projections based on global model scenarios. These projections will form the basis for evaluating the effects of climate change on air quality, and the impacts of changes in air pollutant concentrations on human health. One successful EPA product is the GLIMPSE model, which assists decision-makers in federal, regional and state-level planning organizations analyze the benefits and trade-offs of evaluating air quality and climate benefits compared to different policy and technology scenarios. In FY 2017, the GLIMPSE model will be updated to include a new energy modeling component, which will provide users a more streamlined experience.

Climate Impacts on Watersheds, Water Quality, and Ecosystems

A key research area is to improve measuring and monitoring capabilities to pin-point risks to watersheds, water quality, and ecosystems across geographic areas. Once identified, EPA will use this data to assist with responding to these risks. In FY 2015, the EPA created a draft water quality and climate change assessment report, in which EPA scientists assessed technical literature reviews addressing potential climate change impacts on watersheds and coastal ecosystems. In FY 2017, the EPA will create a website based on the report, featuring policy relevant information for EPA program offices and Regions, including links to tools, data and related websites. This is one of several EPA projects to consolidate a synthesis of emerging scientific literature on the effects of climate change on water quality.

Topic 2: Emission and Measurements

The EPA will continue to conduct research to support critical Agency programs, including applications for implementation and compliance with relevant air pollution standards. Additionally, the funding will support next generation air monitoring research to advance the field of air pollution sensors and their integration with related measurement technologies and databases. The following describes ACE's long term commitment to developing methods for air pollution measurement, as well as an example of one of several next generation air monitoring projects.

Methods for Measurement to Inform Policy Decisions

In FY 2017, the ACE program will continue to develop methods to characterize the composition of air pollution, analyze health and ecological impacts, identify pollution sources and develop solutions to improve air quality. Internal and external stakeholders identified a number of source and ambient air pollution measurement and monitoring-research needs including development, evaluation, validation and review of measurement methods for regulatory requirements. This includes the Federal Reference Methods (FRM) and Federal Equivalent Methods (FEM) to support National Ambient Air Quality Standards (NAAQS), New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP), State Implementation Plans (SIPs), the Regional Haze Rule, and potential climate change rules. Additional measurement methods to support and enhance tools are needed to: support policies, identify and quantify source impacts, improve the accuracy of emissions inventories, and provide data for model evaluation and application.

Multi-scale, Multipollutant Air Quality Modeling

In FY 15, the San Francisco-based company Aclima partnered with Google Earth Outreach to map and research urban air quality. The Google cars monitored levels of toxic air pollutants, while the EPA successfully provided scientific expertise in study design and instrument operations. As air sensor technology advances, activities like Google's Street View mapping will provide a layer option to Google Maps, which will change how citizens view air quality in their immediate surroundings. The EPA benefits from this project in several ways. First, the EPA can access a range of data that Google and Aclima provides. Second, the EPA can shape the nation's standards for air quality data management.

This partnership is a successful example of how a federal agency can work with external stakeholders to educate the public about personal and community air quality levels, as well as mutually benefit from shared resources. In FY 2017, the EPA will continue to collaborate with Google and Aclima, to identify locations for long-term air quality monitoring, and build scientific models to define data quality standards for air pollution monitoring. These activities support ACE's third objective to prepare for and respond to changes in climate and air quality.

Topic 3: Atmospheric and Integrated Modeling Systems

The EPA will continue to research and develop next-generation air quality models that integrate multiscale and multipollutant capabilities. These tools will support the development of major energy and transportation sector rules, assess risk posed by hazardous air pollutants, and produce local and regional-scale air quality and climate data products. The following is an example of an EPA developed tool that demonstrates its far-reaching capabilities and on-going support functions.

Multi-scale, Multipollutant Air Quality Modeling

In FY 2015, the EPA released an updated version of the Community Multi-Scale Air Quality Model² (CMAQ), allowing users in over 50 countries to simulate air quality in metropolitan areas, identify air pollution hot spots, and develop potential remediation strategies. The system links meteorological and emissions models to simultaneously model multiple air pollutants, which helps air quality managers determine the best pollution management strategies for their communities, regions and states. For example, CMAQ provided data for the New Fuel and Car Standards rule, finalized by the EPA in 2014. Under this rule, the standards will help avoid up to 2,000 premature deaths per year and 50,000 cases of respiratory ailments in children.

In FY 2017, new scientific information will be considered and incorporated into CMAQ to ensure it continues to provide state-of-the-science predictions and analyses to inform the most accurate, efficient and cost-effective ways to reduce harmful pollution concentrations. A continuation of funding for atmospheric and integrated modeling projects such as CMAQ is critical because researchers, regulators, consultants, academia, and the private sector rely on the EPA's data to determine how air pollution can be managed locally and nationally. For states, the tool is used to develop and assess implementation plans to attain National Ambient Air Quality Standards.

Topic 4: Protecting Environmental Health and Well-being

The EPA will continue to conduct research on air pollution, which will inform the development of new policies to protect public health and welfare by EPA and its Agency partners and external stakeholders. The ACE program will measure progress toward environmental health goals, and translate research results to inform communities and individuals about measures to reduce impacts of air pollution. The following is an example of an EPA developed tool that informed the development of new policies aimed at protecting public health and welfare.

Understanding Factors that Influence Air Pollution Related Public Health Impacts

Since the development and completion of the mobile smog simulator, the first set of experiments began in FY 2015 by creating reproducible atmospheres containing Secondary Organic Aerosols (SOAs). SOAs are air pollutants emitted from natural and man-made sources, and are a major component of fine particle pollution that causes lung and heart problems. The smog simulator successfully analyzed the health effects of air mixtures on animal models, cell cultures, and plant systems. It also created customized smog "recipes" across regions and simulated temperature scenarios to evaluate impacts on the atmosphere.

In 2017, the EPA will continue to examine air pollutant mixtures exposure rather than single contaminant exposure to reflect a real-life experience. This research is conducted to illustrate how regional differences of air pollution may impact public health. Reproducible atmospheres were created, containing Secondary Organic Aerosols (SOAs). With continued funding, the EPA believes that stronger partnerships with external stakeholders can be formed by making the simulator a national resource for SOA research. The smog simulator played a key role in supporting Agency priorities by producing data to set National Ambient Air Quality Standards, and continues to provide further research opportunities in modeling. The EPA will translate the

² For more information, <http://www.cmaq-model.org/>

results of this and other related research to better inform the public about measures they may take to reduce the impacts of air pollution. This will include addressing ways to lower exposure and limit the health effects at the individual, community, or ecosystem level.

Topic 5: Sustainable Energy and Mitigation

The EPA will continue to advance data translation and tools to evaluate energy impacts at a national and regional level, analyze the performance and environmental consequences for production and conversion technologies, and research the environmental impacts of energy end-use. The following demonstrates a key research area for supporting Agency priorities and the Mission Innovation Challenge.

Implications of Major Changes in Energy Production and Conversion Technologies

In FY 2017, the EPA will continue to collaborate with the Department of Energy (DOE) and the Department of the Interior (DOI) as part of the Federal Multiagency Research Strategy on Unconventional Oil and Gas Research. This research strategy will assess the potential impacts of hydraulic fracturing on air quality to support sustainable approaches to unconventional oil and natural gas development and production. This research will include a focus on air toxics and tropospheric ozone precursors. The ACE program will work in conjunction with the Safe and Sustainable Water Resources (SSWR) program to study the potential impacts of hydraulic fracturing on water quality and ecosystem resources.

Performance

The table below reflects the ACE program's annual performance measures. The EPA uses these measures to assess the effectiveness in delivering products and outputs to clients and decision-makers at the federal government level.

Performance Targets:

Measure	(AC1) Percentage of products completed on time by Air, Climate, and Energy research program.								Units
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	
Target			100	100	100	100	100	100	Percent
Actual			100	92	87	87			

Measure	(AC2) Percentage of planned research outputs delivered to clients for use in taking action on climate change or improving air quality.								Units
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	
Target			100	100	100	100	100	100	Percent
Actual			77	83	92	74			

The EPA has established a standing subcommittee under the EPA's Board of Scientific Councilors (BOSC) for the ACE program to evaluate its performance and provide expert feedback to the agency. In addition, the EPA will meet regularly with both the BOSC and Science Advisory Board (SAB) annually for input on topics related to research program design, science quality, innovation, relevance and impact. The EPA will be advised on its strategic research direction as part of the review of the Research and Development programs' recently-released

Strategic Research Action Plans (StRAPs).³

The EPA collaborates with the National Institutes of Health (NIH), National Science Foundation (NSF), Department of Energy (DOE), U.S. Department of Agriculture (USDA) and the White House's Office of Science and Technology Policy (OSTP) to assess research performance. The EPA supports the interagency Science and Technology in America's Reinvestment, Measuring the Effect of Research on Innovation, Competitiveness and Science (STAR METRICS) efforts.⁴

FY 2017 Change from FY 2016 Enacted Budget (Dollars in Thousands):

- (+\$1,879.0 / - 5.4 FTE) This program change reflects an increase of \$2,117.0 to fixed and other costs for the agency recalculation of base workforce costs due to adjustments in salary, working capital fund, and benefits and a net decrease of \$238.0 and 5.4 FTE from essential research program support.
- (+\$1,496.0 / +4.5 FTE) This program change reflects an increase to the EPA's study of the potential impacts of hydraulic fracturing on air quality to support sustainable approaches to unconventional oil and natural gas development and production.
- (+\$3,000.0) This program change³ reflects an increase to study the environmental and resource conservation impacts of clean fuels use on air and water quality, soil quality and conservation, water availability, ecosystem health and biodiversity, invasive species, and on the international environment.
- (+\$908.0 / -1.1 FTE) This program change reflects an increase to research related to the development of next generation air quality models needed to integrate multimedia and climate models with air quality models as well as \$360.0 to support laboratory consolidation efforts.
- (+\$1,962.0) This program change reflects an increase to research climate change and nitrogen interactions, develop long-term emissions inventories for differentiating changing emissions related to human activities, and study the benefits and impacts of an alternative energy infrastructure on the environment.

Statutory Authority:

Clean Air Act; Title II of Energy Independence and Security Act of 2007; Environmental Research, Development, and Demonstration Authorization Act (ERDDAA); Intergovernmental Cooperation Act; National Environmental Policy Act (NEPA), § 102; Pollution Prevention Act (PPA); Global Change Research Act of 1990.

³ EPA Strategic Research Action Plans, <http://www.epa.gov/research/strategic-research-action-plans-2016-2019>.

⁴ STAR METRICS, <https://www.starmetrics.nih.gov/>

³ Part of the President's Mission Innovation commitment to dramatically accelerate public and private global clean energy innovation